

**Work and health**

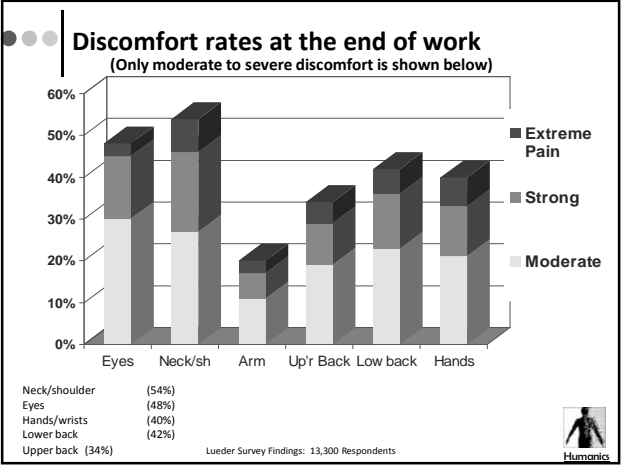
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My grandmother, Mina Seeger:  
1920's Boston court reporter on Sacco & Vanzetti case.

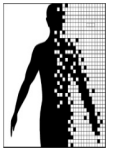
Somewhere, somehow,  
something went terribly wrong...

We assume people will adapt to technologies



Notice anything about this picture?

EXPLORING VENTURES: Idealab workers at its headquarters in Pasadena.



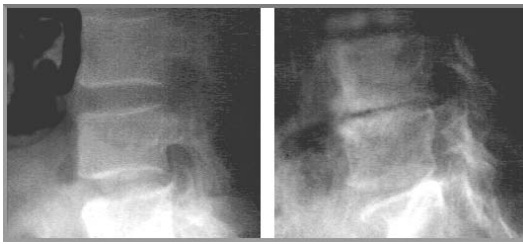
●●● **Nobody is leaning back**




GARY FRIEDMAN LOS ANGELES TIMES  
EXPLORING VENTURES: Idealab workers at its headquarters in Pasadena.



●●● **X-rays: Same person 20 years apart**



**Not only are people different, they change over their lives**



●●● **"There are more things in heaven and Earth,  
Horatio, than are dreamt of in your philosophy"**  
Shakespeare's Hamlet (Act 1, Scene 5)




Photos courtesy of Cindy Burt, OTR/L, CPE




●●● **Women sit differently**



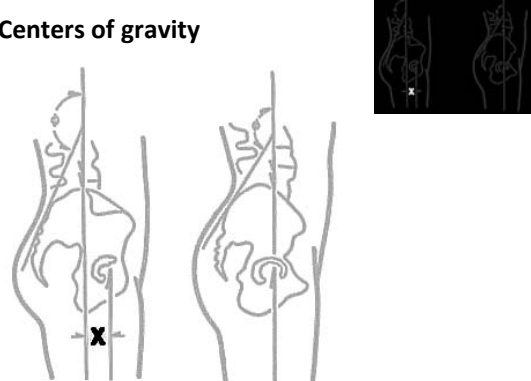

●●● **... than men**




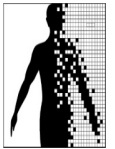
Courtesy of Cindy Burt, OTR, CPE



●●● **Centers of gravity**





Tichauer, E. R. (1978) *Biomechanical basis of ergonomics: anatomy applied to the design of work situations*. Wiley, John & Sons, 99.



### Centers of gravity

Pelvic tilt relates to gender, aging and obesity

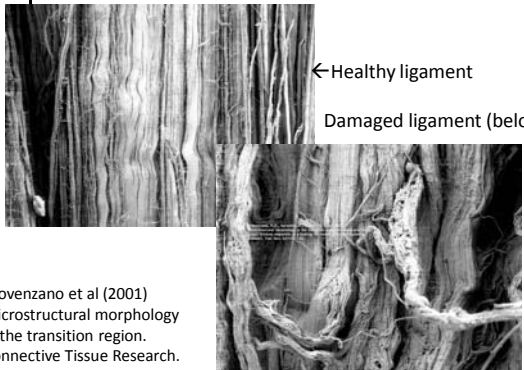



### Comfort ≠ what's best

If posture is not supported, people usually sit and stand in ways that will minimize the amount of muscle work.





### Comfortable ≠ best




← Healthy ligament  
 Damaged ligament (below)

Provenzano et al (2001)  
 Microstructural morphology in the transition region.  
 Connective Tissue Research. 42, p123-133.



### Static postures → demineralization



55 YEARS      AGE 65 YEARS      Spontaneous, Sometimes Painless, Compression Fractures of Thoracic Vertebrae Lead to Loss of Height


AGE 75 YEARS  
**ADVANCED SYMPTOMS**

Dowager's Hump\* - Forward Bending of Upper Spine

With Loss of Height, Rib Cage Descends and Sometimes Comes to Rest on the Pelvis.

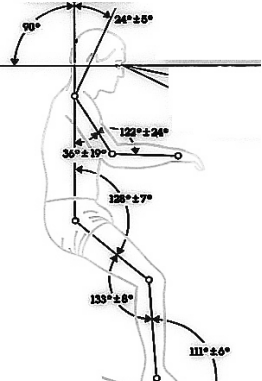

Downward Pressure Causing Abdominal Bulging

Hip, Arm and Wrist Fractures Occur with Minimal Trauma



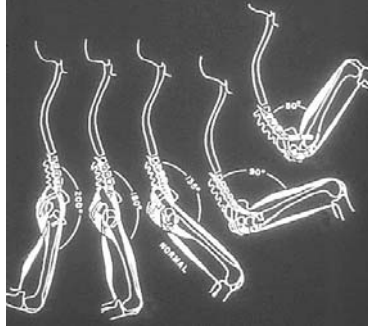
### Neutral postures?

- Balance muscle loads
- Reduce physical demands
- Relieve physical stress


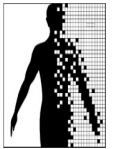



### Keegan (1953)

Keegan performed repeated x-rays of a single person lying on their side.



Keegan, J.J. (1953) Alterations of the lumbar curve related to posture and seating. *Journal of Bone and Joint Surgery*. 35A, 3, 589-603.

●●● Keegan's repeated x-rays of a single person

Standing      Sitting erect      Sitting relaxed

Keegan, J.J. (1953) Alterations of the lumbar curve related to posture and seating. *Journal of Bone and Joint Surgery*. 35A, 3, 589-603.

●●● Intradiscal pressures

Activity	Intradiscal Pressure (N)
ARMS HANGING	~500
WRITING	~500
TYPE-WRITING	~600
LIFTING WEIGHT	~700
DEPRESSION OF PEDAL	~500
RELAXED	~400

Andersson, B. J.; Ortengren, R.; Nachemson, A.; Elfstrom, G. (1974) Lumbar disc pressure and myoelectric back muscle activity during sitting. I. Studies on an experimental chair. *Scand J Rehabil Med*. 6(3), 104-114.

Wilke, H. J.; Neef, P.; Caimi, M.; Hoogland, T.; Claes, L. E. (1999) New in vivo measurements of pressures in the intervertebral disc in daily life. *Spine*. 24(8), 755-762.

●●● Lumbar support

●●● Shifts in posture changes the dynamics

Corlett & Eklund (1984) How does a backrest work? *Applied Ergonomics*. 15(2), 111-114.

●●● Dynamic back support



●●● **Seat pivot**

Dunk, N. M.; Callaghan, J. P. (2005) Gender-based differences in postural responses to seated exposures. *Clin Biomech* (Bristol). 20(10), 1101-1110.

●●● **Head support**

●●● **Seat height and depth**

●●● **“Rotatory” movements**

van Deursen, D. L.; Lengsfeld, M.; Snijders, C. J.; Evers, J. J.; Goossens, R. H. (2000) Mechanical effects of continuous passive motion on the lumbar spine in seating. *J Biomech*. 33(6), 695-699.

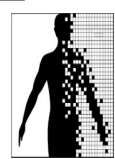
●●● **Seat compression and edema**

Movement promotes circulation and elimination of waste products.

●●● **Too many tunnels**

Symptoms are complicated and unpredictable

30



●●● JFK's rocking chair



●●● SwingChair.com

[www.SwingChair.com](http://www.SwingChair.com)




●●● Variable Balans



●●● Seat pan tilt


Tilt, seating platform



●●● Postural support

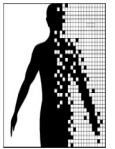
Use the seat to support the muscles and sit, or stand, at the hands with arms. The seat should be level with the feet to the ground angle approximately at the feet to feet.

[www.humanics-es.com/sit-stand-seating.htm](http://www.humanics-es.com/sit-stand-seating.htm)



●●● Multi Balans

[www.varierfurniture.com](http://www.varierfurniture.com)

●●● | Open postures

Padded Edge  
Foot Rail  
Rails

Foot Rest  
Prop Stool  
Jump Seat

●●● | Risk factors

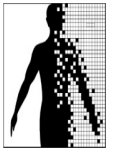
*Screw up one thing,  
screw up everything!*

●●● | Avoid constrained postures

●●● | Fit?

●●● | Fit?

●●● | Fit?



● ● ● **Fit?**




● ● ● **Forearm support**





● ● ● **Physical risk factors**



1. Awkward postures
2. Constrained postures
3. Force (e.g. impact sharp edges)
4. Repetition

*Secondary factors*

- Environment (vibration and cold)
- Personal risk factors (e.g., small carpal tunnel)




● ● ● **What risk factors do you see?**

● ● ● **Good postures are...**


- Centered
- Symmetrical
- Provide support
- Promote free movement (but not repetition)



● ● ● **Motions and Postures**


Design for movement

- Avoid twisted positions, esp. trunk and neck
- Avoid forward bending of trunk and neck
- Avoid static postures, esp. at extremes
- Avoid holding arms raised







**What can you do?**




*Sleeping on your back:  
...put pillows under knees*




*Sleeping on your side:  
...put pillows between knees*


... and support your neck with either a rolled-up towel or neck pillow.




**Driving**





Driving to and from work every day greatly increases the risk of back injury.



**What you can do?**



1. Support your back while driving.
2. Readjust your seat positions regularly.
3. On long trips, take rest breaks.
4. If your car seat isn't comfortable, consider seat and neck supports for driving.
5. Avoid cell phones while driving.

**Pay attention to warning signs!**



Don't take discomfort for granted!  
It's easy to prevent injuries, but hard to recover.


*If it hurts, stop!*

- Give yourself a chance to recover before it gets serious.
- Use ice packs  
→ reduce swelling.
- Avoid loading affected joints.
- If pain continues  
→ talk to your physician




**To download handouts / copy of slides...**

[www.humanicergosystems.com/cocra.htm](http://www.humanicergosystems.com/cocra.htm)



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